Mobile-TV in Finland

The lack of a killer application

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The purpose of this thesis is to investigate the development of, or lack there off, Mobile-TV in Finland. It is quite strange that such a technically advanced country as Finland has yet to see the dawn of Mobile-TV even though we were among the first to try it out. As early as 1996 with streaming TV to our mobile phones and not much later by being one of the first countries outside of Asia to launch a separate Mobile-TV network, using the DVB-H standard, in 2006.

Methods for working and trying to find answers to this were to read into the history of Mobile-TV and interviewing people from the companies working in this market. Best described as an empiric way of working. Also a comparison was made between different technologies used for delivery of video content to the mobile user.

It really seems that we have been and still are missing the real killer application, or usage purpose for Mobile-TV to launch in Finland. This is a result of the fact that for such a long time there was no guidelines for the development – a lot of different technologies were used and none have caught on with the public. However there seems to be a consensus between operators and distributors that one major key factor in getting Mobile-TV off is to offer it to the user when they want it. Meaning on demand services, though how the content will be delivered is still an ongoing battle.

Keywords:	Mobile-TV, IP, DVB, DVB-H, Digita, Telia Sonera, DMB, MBMS, 3G, 4G, internet, media, on-demand, simulcast, broadcast
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FOREWORD

Mobile-TV, Digital-TV, content-on-demand, mobile multimedia, real-time streaming, DVB, etc. are all almost daily terminology, yet for some reason in Finland still not part of the daily life of consumers.

Is it still the next big thing?

My interest in this subject has a long stemmed history from years of work at one of the largest mobile phone companies in the world. Looking from the sidelines how this mobile entertainment business has been growing in almost all other countries globally, except for Finland.

The goal for this thesis is to look into two main questions; what is considered Mobile-TV today and what is the status of Mobile-TV in Finland.

Grankulla, December 2010

Mikael Kanervo

1 INTRODUCTION

This thesis will dwell into the question why Mobile-TV has not launched in Finland as many companies did think in the beginning when first introduced. It is not that it's a new technology, it is said that new Mobile-TV applications are launched daily (Kumar, 2007) on a global basis, but why isn't it yet mainstream in Finland?

Mobile-TV is already, and has been, a part of daily life in many countries like Japan and South-Korea, so my task is to look more specifically into questioning why this has not happened in Finland, the technologically savvy country whose own Nokia was the first on the market with a DVB-H mobile phone. One can state that it is a known fact that Mobile-TV has had a really slow start in Finland (Eronen, 2010) (Grönvall, 2010), and has probably been restricted by the lack of content, devices and of course views on copyright issues. On the other hand at the same time, it is estimated in a recent research paper that Mobile-TV is on its way to a quick rise in Europe and in Finland (Järnefelt & Kievari 2009). There are examples from successful implementations from a lot of different countries in Europe, but there actually may lay one of the other obstacles for Mobile-TV in Europe. The split of countries and chosen technologies – one could speculate that in this sense it will be (and probably has been) easier for example for USA to launch Mobile-TV services.

The next big question of course being to specify what exactly Mobile-TV is, the classical way of seeing this is as a mobile way of simultaneously watching TV broadcasts as they are broadcasted through traditional channels – but today with the ever increasing internet connected mobile devices, the idea of Mobile-TV is changing.

But still the word Mobile-TV is a daily term in media today. For example just by using the Finnish term "mobiili-tv" for an online search it gives me over 700.000 hits – only in Finnish! The interesting part is though that most of them are regarding DVB-H (Digital Video Broadcasting – Handheld), which doesn't seem to have hit off despite of it's online "popularity". According to my point of view, there's a lot more to Mobile-TV than DVB-H and this is something I will address in this thesis. Is the fact that, we are again, trying to essentially do the same thing with many different technologies?

Best to my knowledge the DVB-H standard is quite a restricted medium and the technology is not that standardized (differences between countries; www.mobiilitv.fi, päätelaitteet, 2010). But interestingly though it is DVB-H that has the highest media hit rate, at least in Finland.

2 QUERY COMPOSITION

Mobile-TV, though it is a relatively new thing is a proven thing of today. Meaning it is here, but what is the status today? Is DVB-H really the technology the operators should invest in? In this thesis I will use the term operator for either a TV-broadcaster/distributor (e.g. Digita) or a mobile operator (e.g. Telia Sonera). This general term will also pose one of the sub questions, who should be the distributor of the material? Is it the traditional TV-broadcaster or a mobile operator?

Already for a long time multimedia has been delivered via mobile networks. Is it worth building a totally new infrastructure, with transmitters and receivers, as we already have IP solutions that even are already standardized (e.g. MBMS, 3GPP)?

As delimitation for this thesis the following queries will be used;

1) Why does Mobile-TV not have a killer application, in Finland?
2) What is Mobile-TV?
3) What is a killer application and why do we need it?

The answer to the question, why there isn't a killer application for Mobile-TV in Finland, I will try to find by doing a combination of comparison and analysis of the development between Mobile-TV and mobile telephoning. The target for the analysis is to find the "killer application" that is missing from Mobile-TV, which obviously mobile telephony has, when we consider that it has a penetration of 100% in Finland.

The question is; where did the development of Mobile-TV go the wrong way.

When it comes to the technological part of the question, the format is an important issue I will dwell into – through looking at different methods of distribution for wireless multimedia. But this will not be a technical view of Mobile-TV, more so an analytical view of the business. Also a basic historical view and then a more limited comparison between the three biggest alternatives (as I see it): DVB-H (e.g. Digita), IPTV (according to the 3GPP standard, e.g. Saunalahti Mobile-TV and a dedicated streaming application e.g. YouTube or Sonera Mobile-TV app).

2.1 Delimitation

To be able to restrict and keep this thesis in some form it was important at an early stage to limit the questions to be tackled. Of course many views are explored and a lot of background investigation had to be done, but the important delimitations for this thesis are:

- The market - as this is an analysis of Finland
- Distribution - what exactly is Mobile-TV? Is it broadcast or on-demand services?
- Quality – a technological comparison will not be main point

3 THEORY

DVB-H is the technology most thinks of when they hear the word Mobile-TV. Or perhaps not the technology itself, but how the broadcast is sent to the user and what device to watch the broadcasts with. I can already come to this conclusion just by searching online or talking to friends. But as I have already found out, there are several other ways of delivering Mobile-TV. We can either stream it over the internet (i.e. 2G/3G/4G networks) according to the 3GPP protocol (or other similar technology) or we can even develop our own video applications within the idea of IPTV and not be restricted to a specific mobile protocol.

3.1 What is Mobile-TV

What is Mobile-TV, that is a good question to start with. Because I feel that television today, even in the traditional non-mobile view, is not the same thing as we have perceived it to be the last 80 years. The question more correctly I guess would be what is mobile entertainment, as I wanted to look at this question not only to par DVB-H technology against the other technical solutions, but also simulcast versus on-demand delivery of content and address the question what is actually Mobile-TV.

Mobile-TV, as I see it, can be split into two main categories and two subcategories;

Broadcast, in other words where the content is distributed or sent from one point to several clients using for example DVB-H, DVB-T, DMB or MediaFLO technologies. The content can be a sort of loop of content or a simultaneous broadcast of a traditional television broadcast.

Unicasting, which could best be described as sending from one point to one point, or more simply put through a point on the Internet to your client device.

The subcategories, if you will, would then be the type of 'casting', either *simultaneous broadcasting* (or simulcast) of material from a traditional broadcast or *on demand*, where the material is stored somewhere and retrieved on demand.

Simulcast is then the version of the technology where the programming is sent at the same time as on traditional TV broadcasts, i.e. simultaneous broadcasting. So you are restricted to a schedule and (possibly) location of programming. The most commonly used technology for this kind of broadcasting in Europe is DVB-H, which is a derivate of DVB, which is the norm of Digital Video Broadcasting and is especially designed for mobile broadcasting, H standing for Handheld. The problem, as I see it, is that at least for now DVB-H is only used for simulcast broadcast, which is a limitation. But I think the mobile user cannot be expected to be "available" at a specific time, but instead to be able to consume the content when he is free. Also a problem seems to be the distribution, yes it has the advantage of being able to use DVB-T networks as a base for distribution, but still does need upgrading of networks and thus not that widely available.
DVB-H does of course have its advantages over other technologies. It is often better in quality than the other distribution technologies and has the big TV broadcasting companies behind them. The problem lies in the technology itself, which requires proprietary hardware and this is very scarcely available, in comparison to the other solutions like IPTV and 3G/3GPP.

The other category would then be **On-Demand**, where the most used technologies are IP based, for example using the internet for delivering the content to the user on-demand. There are a lot of different methods for distributing material through IP, but most common are MBMS and propriety solutions like a standalone software application for a device. The advantage of this type of broadcasting is that the infrastructure for the broadcasts is already there. One is able to use any means of IP delivery system to broadcast video - is it then 3G, Wi-Fi or some other means of connectivity.

3.2 What is a killer application

A killer application can be seen as the function that drives a technology from obscurity to mainstream. A good comparison, which I will be using, is mobile telephony. There is no research to see if mobile telephony has been a success and continuing to be so. But what is it that has made it to be so successful?

This is exactly why I want to make the research on Mobile-TV. To find out what is the killer application needed to make the transition from something cool to show to mainstream. For mobile telephony I can see two main killer applications. The first one was SMS – a completely new way to communicate, short and fast, without needing the receiving part to actually be available at the time of contact. Then what I see as keeping mobile telephony continuing to be such a growing success is the continuing evolving. Of which the latest killer application can be seen as mobile Internet. We are now at such speeds and possibilities on our mobile devices that we could only dream of on our Personal Computers just a few years ago. It's already considered mainstream to be on chats, social media sites and streaming music on the road – so is Mobile-TV the next step?

4 HISTORY

The idea of mobile television is not new - the concept however seems to be evolving. The history of Mobile-TV can be seen as being started in 1977 with the MTV-1 or Micro vision. It was a portable TV set with a 2 inch CRT (Cathode Ray Tube) screen and was also the first television to be able to receive signals in several different countries. This was the result of an over ten-year research project. Also Sony tried to dabble into Mobile-TV after the success with mobile music, i.e. The Walkman. Which was (also) considered stooped at the point of conception in the late seventies, a well known comment at that time from the media was something on the line of; "who ever would want to listen to music on the move and alone". Well we all know where this went after the Walkman's and iPods of this world took off. But this concept of Mobile-TV however did not take off. This was probably due to the size, usability and the quality of the devices of that time. The size issue has seemingly been taken care of today, with the introduction and huge success of mobile telephones and also the second part the usability is also something that has been vastly improved. Quality is it then of the actual broadcast or physical device is always, a matter of opinion. In my view this will always be the case.

But Mobile-TV in the sense I'm looking at things could be said to have started in 2003 when NEC introduced the first prototype of a mobile phone capable of receiving mobile television broadcasts. Later in 2003 Sanyo introduced a prototype device that could in addition to watching the broadcasts also record them. First actual broadcasts and devices available to consumers were introduced in 2005, when Satellite-DMB and Terrestrial-DMB was launched in South Korea. Today Japan and South Korea are the drivers of this developing technology. The operator CSL was the one of first to launch a Mobile-TV service over 3G networks in Hong Kong, in March 2006. Even though CSL was the first to launch a larger service over mobile networks, it has to be mentioned that the first public tests of mobile TV broadcasting in Finland was done as early as 2004 (Eronen, 2010). Telia Sonera broadcasted a simulcast of CNN news through their mobile portal, Surf Port. But already in 2006 this was expanded to a live broadcast of the Torino Olympic Games.

One of the first to launch Mobile-TV service outside of Asia was British Telecom in the UK (September 2006) and Digita in Finland (December 2006).

Looking more in detail into the history of Mobile-TV in Finland, it was actually already in 2005 that the first DVB pilot was conducted simply called FinPilot (1) (Järnefelt & Kievari, 2009).

This was an investigation into Mobile-TV conducted by Yleisradio, MTV, Nelonen, Digita, Nokia, Elisa and Telia Sonera. In the research answers were searched for questions like what, why and where was watched. In the research there were 16 channels available to testers. The results of the research showed one interesting thing, that the time to watch content was significantly shorter than that of traditional TV. The three most popular places to watch mobile TV, during this research, were on transport (i.e. Public or in the car), home and the office. Also an important insight from the research was that the viewers also wanted a diversity of content.

So in 2006 the two year program, Finnish Mobile TV (Fit) was started, in this collaboration the fore mentioned companies were joined by Destia, City of Helsinki, Hewlett-Packard, IBM, SWelcom, TietoEnator, Veikkaus, VTT, WM-Data and YIT. The goal for the FiMTV program was to make it easier for the content providers to create innovative and interactive Mobile-TV content – by offering DVB-H capacity and Mobile-TV devices to them. The main insight from the FiMTV program was that there was not a lot of knowledge or experience in the interactive area – and this was a key point for the content creators.

In 2007 the second phase of the FiMTV program was launched, the so-called FinPilot 2, which concentrated on the consumer experience. Extra detail was given to interactive feature. For this pilot Forum Virium Helsinki joined Digita, Elisa, MTV Media, Nokia, SWelcom, Telia Sonera, TietoEnator, YLE and VTT. According to this research mobile-TV is used for entertainment and creating your own space. The most popular channel was MTV3. Almost no interactive were used as they were deemed to be difficult to use. Also in this research it was noted that pay-per-view would be the best payment method in Mobile-TV broadcasting (Järnefelt & Kievari, 2009).

According to Digita's questionnaire in 2009 (mobiilitv.fi, 2009) consumers are enthusiastically waiting for Mobile-TV services. Consumers answering to the questionnaire were ready to pay for Mobile-TV services, approximately 5 euro's per month.

Over 1800 consumers answered the questionnaire that was arranged online at www.mobiilitv.fi. Of this test group only 10% were actually using Mobile-TV services. The vast majority of the consumers answering were male and most of them were between the ages of 31 and 40. Interesting was that most were as said interested in Mobile-TV services, but only 37% of the consumers were actually ready to buy a new mobile device to watch the broadcasts.

Currently you can view the following TV channels on Mobile-TV (DVB-H) in Finland (mobiilitv.fi, Dec 2010): YLE TV1, YLE TV2, MTV3, Sub and The Voice. In addition to the broadcasted TV channels also so called image radio channels are broadcasted, currently: Iskelmä, The Voice and Radio Nova. Also traditional radio channels are broadcasted via DVB-H, which currently are YLE Radio 1 and YleX.

5 THE SITUATION IN FINLAND

As already mentioned in this thesis, the start has been extremely slow even though Finland was on the forefront of the developing Mobile-TV technology. And this is true to both DVB-H broadcasts and IP based solutions. I can see that there have been several problems, but a few keep popping up in most sources. One being the lack of control, i.e. there has been no unifying decision as to what technology should be used. Also a big and in my opinion the biggest issue has been copyright issues and distribution. Who should be responsible for acquiring and broadcasting material? Because in the end it is all about the money, even in this business. As I can see it (Fig. 1) having separate operators and distributors seems to be difficult solution. There are too many middle hands of which every one want their cut of the profit. As for being able to deliver let's say a TV show the operator needs to purchase the rights to show from the TV studio as well as pay to the Distributor for the broadcasting of the material. Which would then of course result in that the consumer actually paying not only for the program itself but also for both the distribution or broadcasting and the actual purchasing of the rights and of course the operator's handling fees. A more streamlined solution would probably benefit us consumers in Finland and ensuring a bright Mobile-TV future (Eronen, 2010). As Eronen points out during our interview they, Telia Sonera, want to provide the whole service directly to the consumer. So one could see a direct payment and distribution service as a more logical and really simple choice (Fig 2).

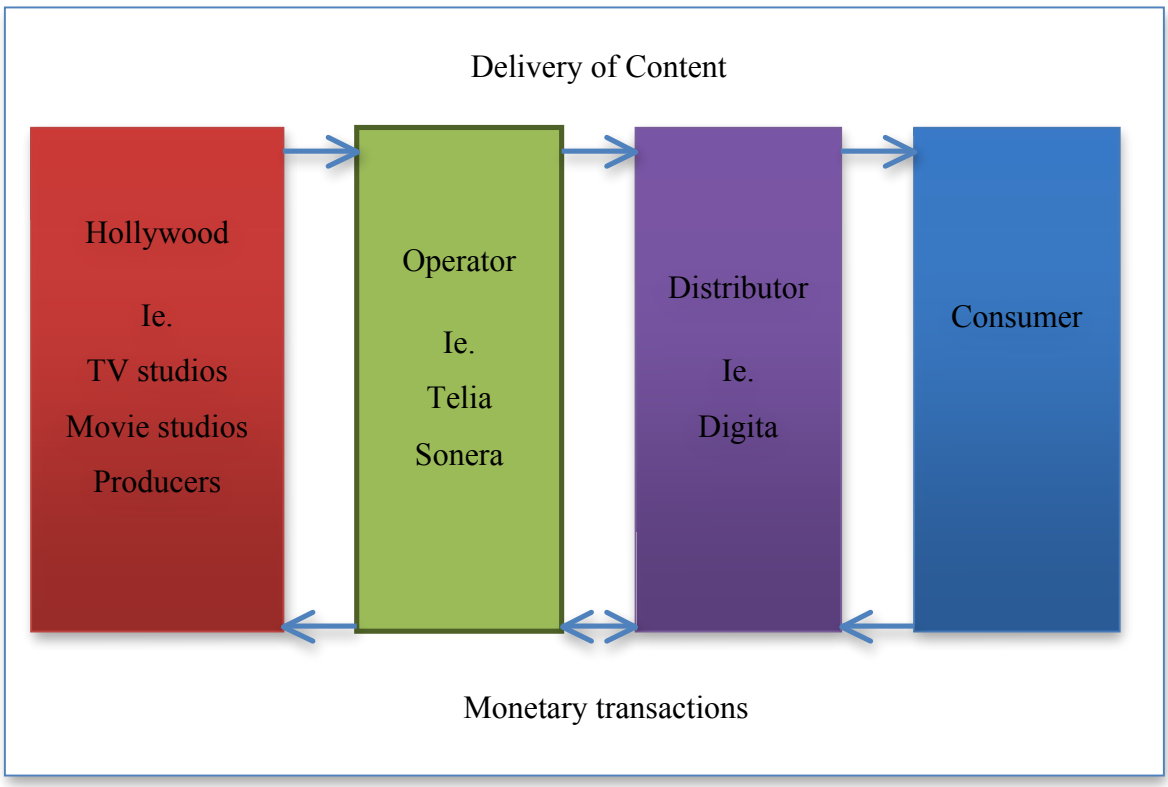

Figure 1.Chart of content delivery contra monetary transactions

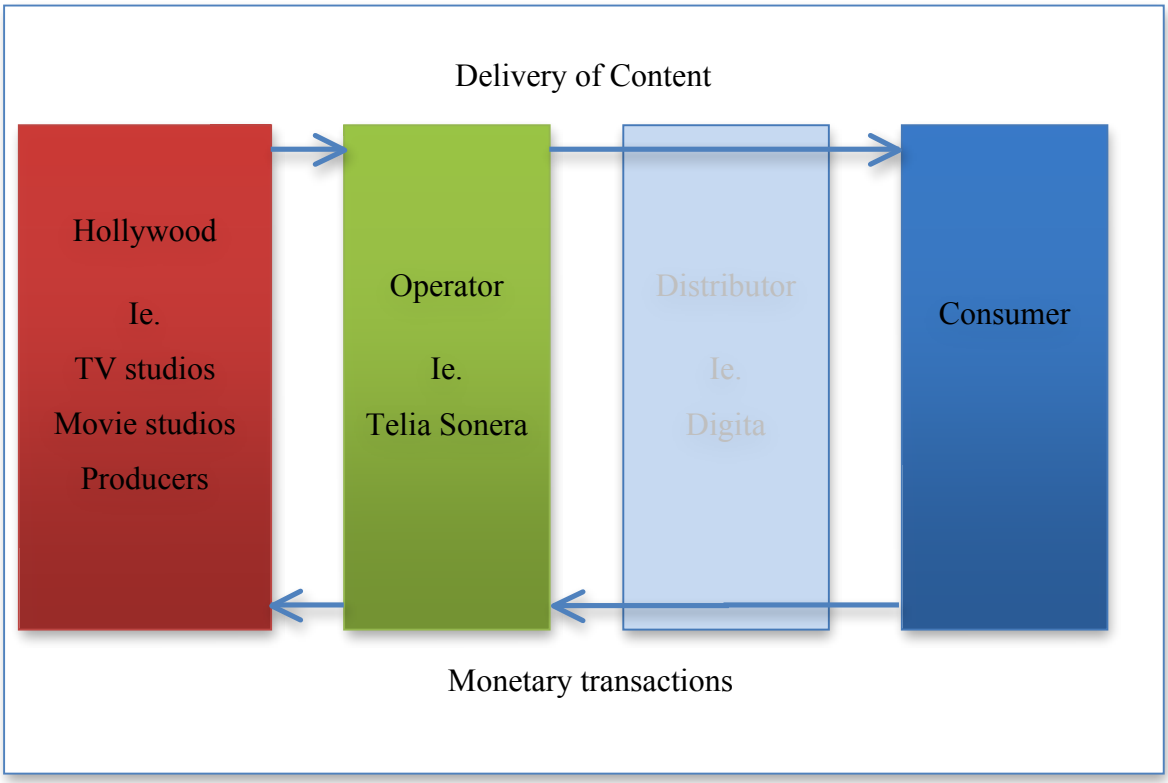

Figure 2. Chart of an optimized content and monetary delivery

As noted several times earlier in this thesis the usage of Mobile-TV in Finland has had a very slow start, even though there were several high profile startups as early as 2006. According to the research by the Ministry of Transport and Communications (Järnefelt & Kievari, 2009) the slowness has been due to the lack of a functioning business model and the unclearness as it comes to copyright and other licensing issues. I can totally agree with this point of view when considering the time when this investigation was made, but today we should have come over these hurdles – at least in the sense of unawareness. The problem however seems still to be the business model, as no one wants to pay for these licenses according to what "Hollywood" wants.

But other important things that I think that have contributed in the slow start of Mobile-TV in Finland, is the lack of devices. The consumer basically has not had the possibility to even purchase DVB-H devices for most of the time the network has been operational. Many of the advertised and promoted products from Nokia have never seen a commercial release, until very recently.

The other crucial thing, when looking at Mobile-TV as DVB-H, is the network availability. Even though according the network license that the government issued back in March 2006 the network has to reach and does so, 40% of the population, it is still very limited. If you look at it very roughly, you can say that it is only available in the greater capital area, Tampere, Turku and Oulu.

This is very limited when compared for example with the DVB-T network, which DVB-H based on, which has a population coverage of 99,9% for the main A & B multiplexes and between 78 and 95% for the C and E multiplexes.

At the same time the high bandwidth third generation mobile networks or 3G networks are being continuously expanded and improved throughout Finland by all three network operators; Sonera, Elisa and DNA. 3G does in fact cover the whole of Finland, though speeds vary a lot – which is the bottleneck of video streaming over the current mobile networks.

5.1 Mobile-TV coverage in Finland

The coverage of services is of course a crucial thing in Mobile-TV. It is no use to produce or deliver services if the service is not available to the user when they want or need it. This is where the mobile network has a slight edge over DVB-H as the 3G networks in Finland are quite widely spread and offer good transfer speeds.

5.1.1 DVB-H coverage in Finland

Digita Oy handles the DVB-H network in Finland. The government issued the network license to Digita on the 23rd of March 2006 and consequently launched on the 1st of December the same year. Digita has accordingly reached population coverage of over 40% (mobiilitv.fi, 2010). The network covers the greater capitol area, Salo, Turku Lahti, Tampere (Image 1.) and Oulu (Image 2.). According to Digita the expansion of the network is completely dependent on the demand for Mobile-TV services and of course commercial decisions.

Image 1. DVB-H coverage in the greater capitol area, Turku, Salo, Tampere and Lahti

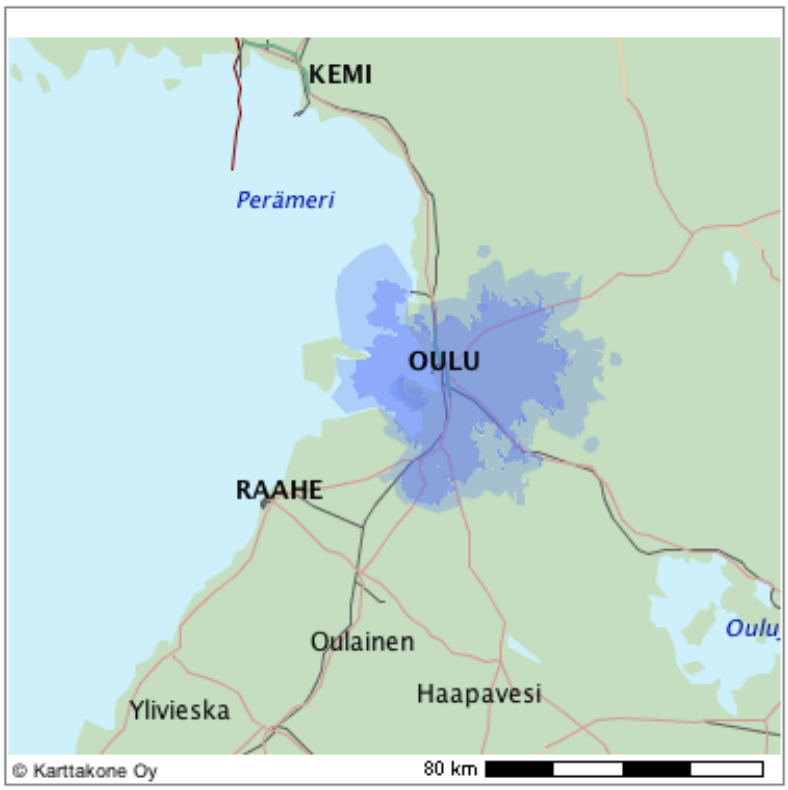

Image 2. DVB-H coverage in Oulu

5.1.2 Third generation (3G) mobile network coverage in Finland

In Finland there are three third generation mobile networks. Telia Sonera, Elisa and DNA provide the networks. The advantage for mobile networks over DVB-H is the already established and wide coverage compared to the DVB-H network. You can receive quite high network speeds on 3G in most of Finland, which is crucial for video delivery. And this is not taking into consideration the 4G networks that the operators in question have signed on to spread out throughout the country in the following years, with public tests already conducted in major cities around Finland.

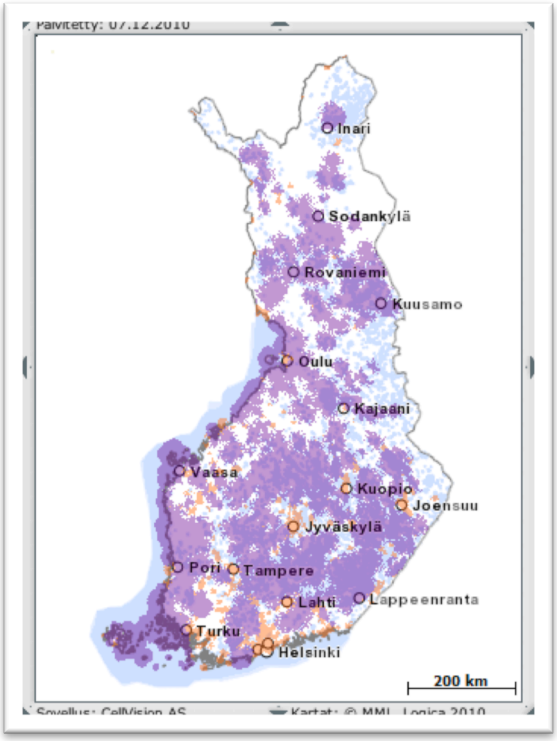

Image 3. Telia Sonera 3G network coverage as of December 7th 2010. Purple showing the 900MHz and orange the 2100MHz band.

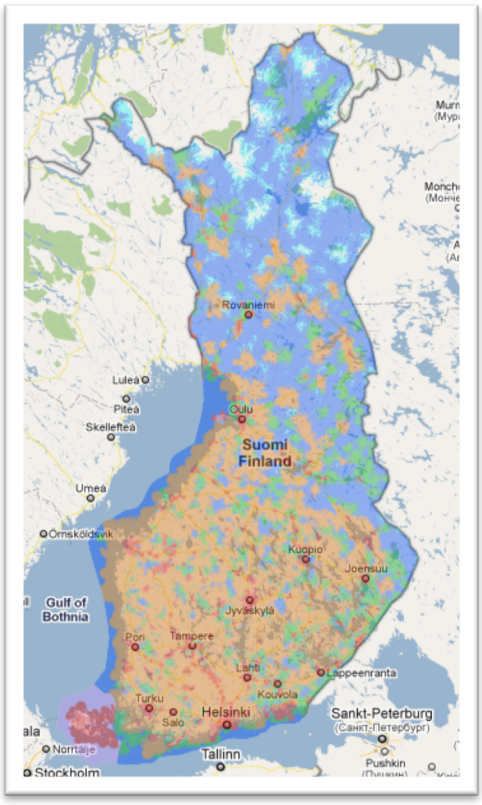

Image 4. Elisa 3G network coverage as of December 2010. Yellow showing the 900MHz and red the 2100MHz band.

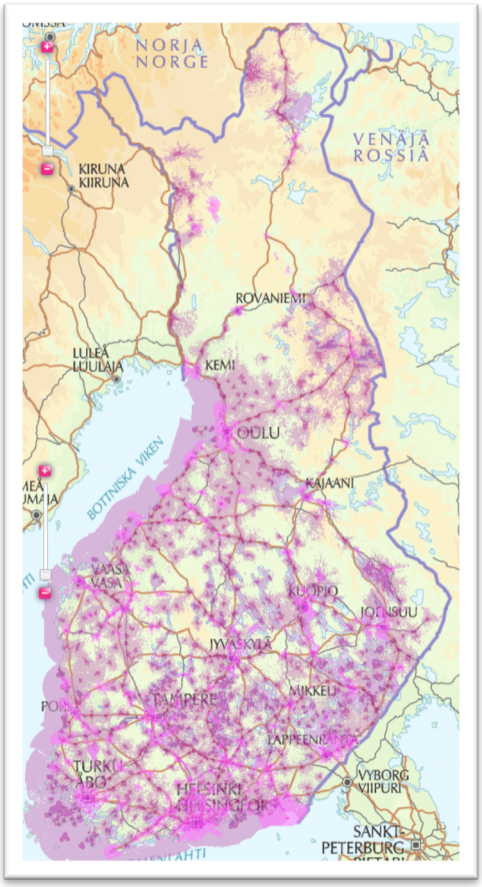

Image 5. 3G network coverage for DNA as of December 3rd, 2010.

6 MOBILE-TV IN THE WORLD

For a good view of the situation in Finland I also wanted to have a quick look at the technologies in use abroad.

6.1 Asia

It is not news to anyone that the Asians are most often on the forefront of any technical advancement and this equally correct for Mobile-TV. As earlier stated the first Mobile-TV networks were launched in Asia and most of them are still working on some level. Especially South Korea and Japan are countries where Mobile-TV has been a part of daily life for a long time.
South Korea was the second country in the world with Mobile-TV 3G broadcasts in 2003 and soon after, in 2005, launched the terrestrial (T-DMB) and satellite (S-DMB) networks. Together these networks provide total coverage of the country. Main advantage of the DMB technology compared to other broadcast technologies is the actual mobility features. T-DMB for example works flawlessly inside and outside and in up to 120km/h speeds and has an extremely fast recovery time if for some reason the broadcast is disrupted.

Japan in their own right started their Mobile-TV broadcasts in 2005. The technology and business plan is however quite different in Japan. Basically a Mobile-TV channel is included in every broadcast license and is free to use for the consumer. Mobile network or 3G is not used for television broadcasts in Japan, only for short video clips – the Mobile-TV broadcast technology of choice in Japan is ISDB-T.

Even though technologically advanced and with extremely high penetration percentages both countries struggle with keeping Mobile-TV a profitable business. Even though in South Korea approximately 17 million people have devices capable of either T or S-DMB broadcast viewing and in Japan 33 million with ISDB-T devices. This means a penetration of 35% and 26% respectively.

6.2 Europe

In Europe Mobile-TV, in the sense of this thesis, is divided into two between DVB-H and IP based services. DVB-H clearly dominates the broadcast networks; with only small volumes of (T-) DMB based networks are available.

A good example of a successful implementation of DVB-H in Europe is in Italy. The network was launched relatively early, in 2006 and currently DVB-H has approximately 2% of the full digital television market, which is estimated to be worth 3.4 billion Euros totally. There is one network provider, H3G and three service providers, who have about 1,3 million subscribers as of the end of 2008 (Järnefelt & Kievari, 2009).

Also Austria, France, Switzerland, Netherland and Norway are quite far in broadcast technologies, with different service solutions. Norway being the odd one out in Europe is using T-DMB as their choice of broadcast technology. NRK, the Norwegian national public service broadcasting company, together with private TV networks have started a two-year Mobile-TV test beginning in 2009. The test is conducted in the major capitol area of Oslo. In May 2009 the MiniTV service was launched using T-DMB technology, consisting of 6 channels. The MiniTV service is operated by Norges Mobil-TV (NMTV), which is co-owned by NRK, TV 2 and MTG.

As for IP based Mobile-TV success full implementations have been made for example in the U.K. and Sweden. In both countries one of the driving forces behind these mobile television services is the operator 3 (Hutchinson). 3 in the UK offer a Mobile-TV service across most of their range of phones. While many of the channels take on the branding of regular channels, for example, MTV and Nickelodeon, the content is actually a recording of programs that is updated about once a week, rather than the full content available through digital television or cable services. The service is provided by 3 and independent companies and offers the main genres of: Comedy, Entertainment, Music, Documentaries, Kids programming and user-submitted content.

6.3 USA

The situation in the United States of America is quite different to all other regions. Here an electronics company has made sizable investments in broadcast based Mobile-TV. Qualcomm has developed and introduced their proprietary technology, MediaFLO, for the US market. According to some estimates the network had only approximately 100000 users during the first years (Järnefelt & Kievari, 2009).

The network covers about 120 cities totaling about 40% of the population. Operators AT&T and Verizon offer packages that include 10 channels for 15 dollars a month. On this the consumer can add extra television and data services.

6.4 The rest of the world

The only larger scale Mobile-TV networks outside of the previously mentioned countries are in South Africa, Nigeria, Namibia and Ghana.

In my interview with John Grönvall (Grönvall, 2010) he mentions that this is the place where he sees a good future for DVB-H. Places where no infrastructure is in place, DVB-H gives in one network the possibility to watch television, make phone calls and surf the Internet. He specifically mentions a project that Sofia Digital has been a part of in South Africa that has been an enormous success. And this is no simple or basic TV network, but a full-blown interactive TV network for MultiChoice Africa.

7 TECHNOLOGY

7.1 Devices

Still today, as mentioned already many times, one of the biggest challenges for Mobile-TV is the client device. For IP transferred video services it is a little bit easier, basically any mobile phone of today can playback video – of course for a good quality feed you would need a device that can take use of the third (or newer) generation mobile networks and/or Wireless LAN.
But this challenge is even more crucial for DVB-H, because still there is only a small handful of devices available of which a lot of have already been pulled from the market due to one or another reason.
Below is a list of all DVB-H devices that have ever been available, as to date December 2010 (DVB-H.org & Wikipedia, 2010):

Gigabyte - GSmart q60, GSmart t600 (actually quite an interesting product, with all networks, DVB-T, DVB-H, T-DMB and DAB)

Image 6. Gigabyte t600. Picture courtesy of Gigabyte.

E-TEN - glofiish V900

Garmin - nuvi 900T (Italy only)

LG - U900, KB620, KU950, U960, KB770, HB620T

Motorola - A680i

Nokia - 7710 (experimental DVB-H version which was never commercially available), N92, N77, N96, Nokia SU-33W (External Bluetooth DVB-H receiver), Nokia 5330 Mobile TV Edition (DVB-H and DVB-T), Nokia N8

Image 7. Nokia 7710. Image courtesy of Nokia.

Samsung - SGH-P910, SGH-P920, SGH-P930, SGH-P940, SGH-P960, SGH-F510

Philips - HotMAN2

Sagem - My Mobile TV, My Mobile TV2

ZTE - N7100, F908, F912, F928, F900 (launched in Q1, 2009)

7.2 DVB – Digital Video Broadcast

Digital Video Broadcasting is a European based consortium and has become a widely used technology for digital TV. Mainly used in Europe, it has already set afoot as a standard with great improvements over the old analog distribution technologies, with more efficient use of broadcasting frequency capacity, multiple audio feeds with multi-channel possibilities. DVB has been standardized separately for Terrestrial (DVB-T), Cable (DVB-C), Satellite (DVB-S) and Mobile usage (DVB-H).

In addition to the video and audio part, DVB also has a standard for DATA (DVB-DATA), which includes the return channels (DVB-RC) for various media and protocols. The return channel can be used through DECT, GSM, ISDN, etc. and protocols include IPTV (internet) and NPI (network protocol independent).

In creating the DVB standard also older technologies were taken into consideration to ease the conversion from analog over to digital. These technologies include teletext (DVB-TXT) and vertical blanking interval (DVB-VBI). But for example for teletext subtitling there are a lot more advanced choices available such as DVB-SUB, allowing several subtitle streams with advanced features like shifting and transparency.

7.3 DVB-H – Digital Video Broadcast Handheld

DVB-H is a derivate of Digital Video Broadcasting (DVB) technology, which is the norm of today for digital TV broadcasting in most of the world, and Finland included. DVB-H was formally accepted as an ETSI standard for mobile broadcasting in November 2004. And from March 2008, DVB-H has officially been endorsed by the European Union as the preferred technology, for terrestrial mobile broadcasting. The major competitors for DVB-H are the MediaFLO system (by Qualcomm), the 3G cellular systems based MBMS standard and the U.S. “based” DVB-SH (Satellite to Handhelds). Also considering the future, competitors include DVB-NGH (Next Generation Handheld) bringing in the future are possible enhancements to DVB-H, providing improved spectral efficiency and better modulation flexibility.

Basically for your device to be able to receive and show the content you need special hardware for your mobile device, i.e. a DVB-H tuner, like you would on your TV set at home. The good thing for DVB-H is that it can co-exist with DVB-T on the same multiplex, but the problem is that it still needs specific equipment to allow sharing of the network and transmission. As the problem is that it needs specific equipment one could argue that is why only 40% of the Finnish population has the availability to view this content (online, www.mobiilitv.fi).

DVB-H is designed to work on VHF, UHF or L bands, so the possibilities are good. This gives for example an advantage over GSM with long range and indoor reception. DVB-H is a superset of the DVB-T standard for terrestrial digital broadcasting – which include features to meet requirements for handheld and battery powered devices.

The advantages of DVB-H are that it can for example offer a downstream channel at high speeds, which can be used as standalone or as enhancements for mobile communication networks. Time slicing is the technology to reduce power consumption for battery-powered devices. IP data is transmitted in bursts of up to two megabits of data. This allows the frontend of the receiver to switch on only for the time of the data burst. So within this short period of time a buffer of stream can be stored to wait for the next burst, thus allowing the device to lower power usage between these bursts. The achieved power saving of course depends on the relation of the standby/on time.

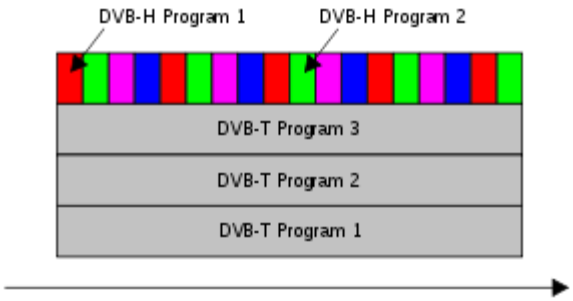

Image 8. DVB-H Frame structure

DVB-NGH

In 2007 it was group was put together to investigate the potential of a DVB-H successor, the DVB-H2 – but the project was shut down quite quickly. In November 2009 however, the DVB group made a call for new technologies that included a new portable

system, the DVB-NGH, or the DVB-Next Generation Handheld. This call is intended to invite technology inputs that would facilitate an appropriate NGH physical layer on which a successful full NGH system could be built.

The goal was to update and eventually replace DVB-H as the standard of Mobile-TV, the new ETSI standard published in 2011, and rollout of the first DVB-NGH devices from 2013.

7.4 DVB-T and DVB-T2 – Digital Video Broadcasting Terrestrial

DVB-T or Digital Video Broadcasting – Terrestrial, has become the norm of terrestrial digital television broadcasting in Europe. The first broadcast with DVB technology was made in the UK in 1997. The system is based on transmitting compressed data including video and audio in an MPEG stream.

Rather than carrying the data on a single radio frequency, DVB and the OFD modulation that it uses, works by splitting the digital stream into a large number of slower streams. Each of which are digitally modulated a set of closely spaced adjacent carrier frequencies. In the specific case of DVB-T there are two choices, 2K or 8K-mode. DVB-T offers three different schemes of modulation; QPSK, 16QAM and 64QAM.

As earlier mentioned, DVB-T has been adopted as the norm for digital television broadcasting in many countries.

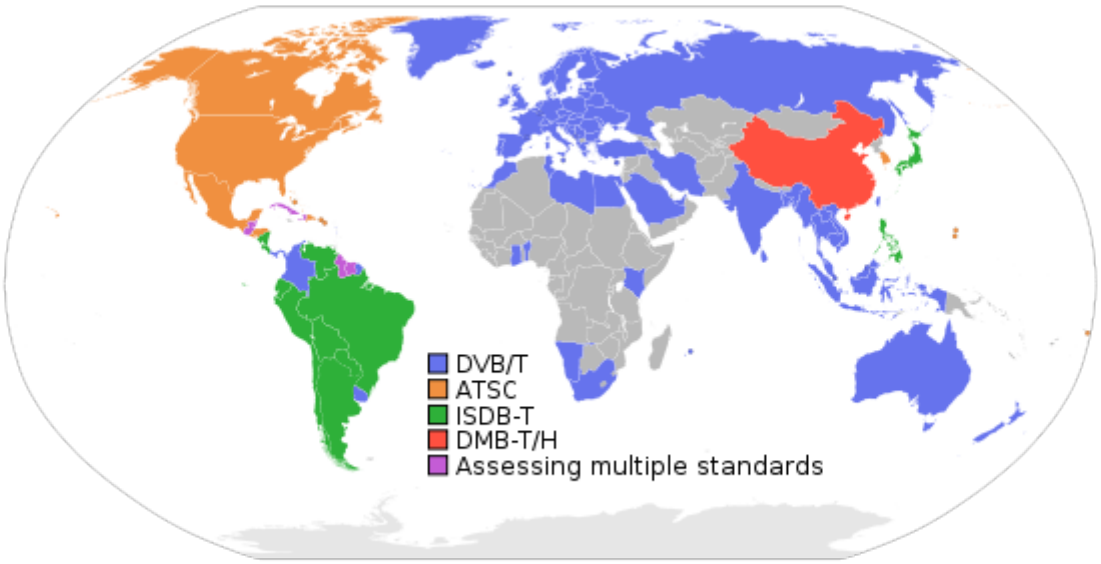

Image 9. Digital TV technologies coverage map, November 2010

DVB-T2 is an abbreviation for Digital Video Broadcasting – Second Generation Terrestrial and is the extension or the next step of the DVB-T standard. In short it T2 will enable higher data rates and thus enabling better support for HDTV programming in the terrestrial networks. T2 has already been adopted by UK, Italy, Sweden and from December 2010, Finland.

7.5 DVB-C and DVB-S – Digital Video Broadcasting Cable and Satellite

Within the DVB specification there are also a lot of other broadcast technologies. Ones used for Cable distribution, Satellite and even DVB-SH, Satellite to Handhelds. And of course the digital TV broadcasting technologies do not stop at DVB, globally there are a lot of other technologies used like ISDB and DMB – but into these I will not explore.

7.6 IP based distribution

This is not a specific technology, but more of a distribution channel. IPTV is usually the generic term for TV delivered over the Internet. But still this is the other way of deliver-

ing Mobile-TV to your mobile device. The advantage IPTV has is that it has a complete infrastructure and most, if not all, mobile devices can use this. The only thing your device needs is an Internet connection and a video player. Then the technical solution is up to the distributor of the content.

The advantage of IPTV over DVB-H is often seen to be the scalability. Usually we talk about META data, i.e. data within the feed that tells the receiving party what content and in what format is available. With this the distribution channel can then have one service or feed, which can be scaled to the receiving device according to its capability, automatically. So for example a tablet device, with high resolution and a broadband connection could receive near HD quality of the same content as the other device with a small screen and basic mobile internet would receive it in lower resolution and bit rate.

One of the bigger standards is the MBMS or Multimedia Broadcast and Multicast Services. It is a broadcasting service specifically designed for the GSM and UMTS cellular mobile networks. One of the advanced features is an uplink service, which allows the viewer or the user to interact with the service, which is not always an easy task to establish with more traditional broadcasting technologies.

7.7 Comparison table of technologies

Technology	Pros	Cons
DVB-H	Open standard. Widely used and tested. A lot of manufacturers ready to deliver devices if adopted in more countries. Supported by EU. No limitation of users.	Only a few devices available on the market.
DVB-T	Includes the most modern modulation and encoding technologies – insuring efficient usage of bandwidth.	No (mobile) devices available in Finland.
DVB-T2	The next standard of DVB-T. Even better encoding and usage of bandwidth. Also a lot of mobile device manufacturers are joined in developing the standard. Possibly replacing DVB-T in the future.	
DVB-NGH	The next step in DVB-H. Supported by DVB Forum, probable includes technologies from DVB-T2. Capacity will increase.	Only in development. Standardization possibly 2010-2011. Estimate 2013 for first devices – best implementation to market, 2015?
MediaFLO	Used in the USA, where there are approximately 10 different devices. Heavily supported by Qualcomm.	EU does not support standard. Cost to run/develop approximately the same as DVB-H. Standard wholly owned by Qualcomm.
T-DMB	Based on DAB (old technology). Not as efficient use of frequencies as with DVB. Supported by government and local manufacturers in South Korea. Tested in Germany, but since ended. Also used in Ghana from 2008.	Uses a lot of bandwidth in comparison.
LTE	Basically the chosen standard for 4G technologies. EMBMS support might prove the best choice for mobile operators to work as broadcasters when they own the networks – and thus can control the network and content.	Mostly 113 simultaneous TV users (TK) – during which no call or other data can be transferred. At that point sees 2.5 times the amount of bandwidth of the frequencies as DVB-H.
S-DMB	Based on satellite and terrestrial fulfillment broadcasts	Stopped in March 2009 in South Korea
DVB-SH	Supported by Alcatel-Lucent and TVMSL partners	Needs a terrestrial network. Seems to need 20-30% LESS transmitters than DVB-H, in addition to satellite. But only little interest outside of France. Not vilely tested, no devices available on market.

Table 1. Comparison of different digital television broadcast technologies

8 CHALLENGES

There have been a lot of challenges to get to the point we are today with Mobile-TV. From the beginning the challenges have been with power consumption, memory-processing power and of course content. Today we have gotten over most of the challenges, like for example processing power and memory. Today's mobile devices have the processing power and memory of personal computers just from a few years ago. But the challenge with mobile that still lies ahead today, anything for that matter is the power consumption and location. Batteries do of course get better and better, but also the devices get more powerful and have larger screens which translate of course into more power usage. These challenges will always be there as the consumer demands more and more, but we are at the point that we can make devices that last for hours when viewing video in wireless networks. However the question or challenge that is still oh-so valid is location, or the reception of the wireless signal. Of course all is good when one is at home, work or a coffee shop where you have access to a Wi-Fi network coupled with a wired broadband network. But this is not mobility per say, and that is where the challenge for both DVB-H and 3G delivered video is equal: How to get the best possible signal to the recipient, even when on the bus, train or deep inside a big building.

8.1 Aggregation

One of the big challenges, which both interviewees also agree upon, is the issue with aggregation. What I mean with this is the complexity of recourses from where the content needs to be collected and purchased. This will, and has, lead to several contracts for different distribution methods towards and from the same companies. There is a need for distribution, broadcast, billing, technical and so-on contracts – and the end result is a lot of work. This is also already at this point, in my opinion, one of the reasons why Mobile-TV has not launched the way everybody expected in Finland. No one has been willing or able to handle this multiple levels of contracts to the same sources for seemingly the same content. As said this is something for example Telia Sonera is working on with their three screen thinking (Eronen, 2010). That the company, in this case Telia Sonera, responsible for distribution to mobile networks would also handle the contracts for other medias. Is it then Telia Sonera themselves or another company specialized in

this is not key, but the important aspect is to agree upon equal contracts for all broadcast mediums. In the sense of Telia Sonera's three screen project this would mean to have the rights to broadcast a TV show for example through normal TV channels (like cable or terrestrial), IP based solutions towards your computer and Mobile-TV, being it then IP based or any other medium.

8.2 Technical

There are a lot of technical limitations or actually today I guess would be more accurate to speak of challenges. As it is seems that anything one can dream of today, will be on the market tomorrow, or is so already even one knowing about it.

The challenges as I see them can be separated into four (4) categories, of which the first would be power consumption.
the power usage of not only the network, independent of what technology DVB-H or mobile, but also the devices other features seem to increase in proportion with the development of features. Of course it is nice to have a large screen with millions of colors, which works in direct sunlight, but it demands a lot from the battery within the device. This is especially challenging when you are looking at the Mobile-TV market as a sub-market of mobile telephony, and the mobile phone as the client device. The user still needs to be able to use her phone for phone calls and other more important features.

The second challenge would be memory. Both in the sense of storage space as well as functional memory. I think the capacity part of the storage has been solved, or overcome, with the ever expanding and growing capacity of memory cards. Today we are already talking of 16GB as the norm of storage space in a mobile device. And if the past trends are anything to look at, this should double within a year. The more challenging part is the memory usage for processing the material that is streamed. It is of course crucial that the client device, again especially if it is your mobile phone, has enough memory to keep the other functions at a functioning standby while streaming the broadcast to your phone.

The third challenge is a continuum from the memory issue, the processing power. Not only does the device need central memory to be able to run the things needed, but of course the processor has to be powerful enough to run the system during this time –

without staggering or causing other vice subpar performance. Is it then the video itself or other functions of the device?

The fourth and final challenge is of course location. Mobile-TV already per definition should be mobile and available everywhere to be a truly mobile function. But how do you ensure equal quality of broadcast everywhere, is it even possible? Mobile networks will always have the challenges of the terrain and DVB the challenges of the amount of broadcast towers.

These are all technical challenges that, as earlier said, can be overcome – and basically all fall back to the first challenge of power usage. The processor and memory technology is there, but at a high cost of power usage. But there is one more challenge that seems to come up everywhere is it then interviews with experts or written reports by Ministries – content. Without content the broadcasters and/or operators will never attract the consumer and without the consumer there will never be Mobile-TV. With mobile telephony the content was created by the users, so it was I guess easy to grow as the more users were introduced the more content was created.

8.3 Legal

Another big challenge for Mobile-TV, as for mostly anything else commercial, is the legal part. In television and radio operation a so called licensing procedure has been used, as the frequencies used in operation of broadcasting is a natural recourse, which is not unlimited. A license is very important because the capacity has to be divided between the interested parties. This license is controlled by the Ministry of Transport and Communications in Finland.

Most of these legislations are local, per country, but also EU has joined the driving of Mobile-TV in an effort to unify the standards throughout Europe. As early as July 2007 the EU commission gave an information (TK)^1 to create the internal marketing of Mobile-TV stronger, which included procedures they were to take to speed up the development of Mobile-TV services. According to this research Mobile-TV is a fast growing innovative service providing and consumer electronics sector, where the global turnover in as early as 2011 could be calculated in the tens of billions Euros. This in comparison would mean up to 500 million consumers.

Lately both the USA and several Asian countries have invested a lot in the development of Mobile-TV, which could mean that Europe could lose its competitive edge, if a unison standard cannot be established, within the European countries.

According to this research the European Mobile-TV market is threatened by fragmentation, if there will be several different standards within the different countries. If this happens, there will be little if any co-operation between the countries, which would lead to the fragmentation of the development market, and ultimately Europe losing its edge by developing different standards.

This is why, according to the research it is crucial that the European countries agree on a common technical standard.

In Finland there are basically two important legislations in regards to Mobile-TV, according to the investigation made by Ministry of Transport and Communications.

The first of which being the Communications Market Act (393/2003) which' purpose is to drive the offering and usages of services in network communication. And also to secure that the communication networks and services are available from all operators to all users in the whole country, within reason.

Also according to this legislation, the offering of consumer digital services in the terrestrial mass communication network or mobile phone network requires a license.

The other important legislation is the Television and Radio operations Act (744/2998) which purpose is to drive the television and radio operations. For the terrestrial television network the government council hands out the licenses, but for the DVB-H network the license procedures have been lightened so that the license can be procured from the Finnish Communications Regulatory Authority.

The license, for DVB-H, does not have to be announced to be searched. The party engaged in television and radio operations in the terrestrial network (DVB-T) does not have to apply for extra license to broadcast its material on the mobile network, DVB-H. Also Yleisradio is allowed to broadcast its material over DVB-H without separate broadcasting license. However the material has to be unmodified and be broadcasted simultaneously within the area of the original license.

The interesting part of the EU commission's research is that it stands heavily behind DVB-H to be chosen as the standard for the pan European Mobile-TV standard. It justifies this by noting that the legislation regulatory varies so much from country to country, that something needs to be done to ensure continued investments and innovation.

8.4 ARPU – Average Revenue Per User

One of the big challenges is of course revenue and earning money. There are 4 main categories of charging for usage of Mobile-TV and of course from there financing the services.

8.4.1 Data usage charges

This is mainly used for so called free services on IP based broadcasts. The user has to have a special data package for watching the available content. The billing can be done by used amount of data or on a monthly basis, usually with a monthly data cap. This is actually where the term ARPU has come from, communication service companies. Companies that offer subscription services to clients for example, telephone carriers, Internet service providers, and hosts use this term. It is a measure of the revenue generated by one customer phone, pager, etc., per unit time, typically per year or month. In mobile telephony, ARPU includes not only the revenues billed to the customer each month for usage, but also the revenue generated from incoming calls, payable within the regulatory interconnection regime.

8.4.2 Commercials

Commercial income is the traditional way of financing television broadcasts. This can be utilized in both broadcast and IP based Mobile-TV. An interesting development in commercials has evolved in the last years, with the introduction of location based applications for mobile devices. This is something a lot of companies buying commercial time are interested in, to be able to have targeted commercials sent to you the consumer accordingly where you are.

8.4.3 Service charges

This is also a traditional way of charging for services rendered. The pay-per-view or monthly fee based viewing experience. There is not that much to explain, everyone understands the concept of a monthly fee for being allowed to view certain services.

8.4.4 TV taxes & fees

National broadcast channels are usually financed with TV taxing or license fees. In Finland Yleisradio Oy according to the public service agreement and law created there for is deemed provide a full service of television and radio programming accessible equally to all. According to the current legislation this is financed with a television payment for watching television.

8.5 Comparison

Today it is quite hard to make a consumer based comparison of the technologies. What I mean with a consumer based comparison is to compare which is technologically better or better in picture and audio quality. Because both technologies explored here, both DVB and IP based, have evolved a lot and today is basically only limited by allowed capacity and processing power of the device at hand. Technically we could deliver HD quality image and sound to handheld devices, the only issue is that it is not applicable yet today – as the toll on battery time is large. Also the usage of HD quality image and sound on a small portable device is questionable, as the image though it might support high resolution images, is really small and the human eye has no possibility to distinguish such small pixels to a useful purpose.

But looking at the future, if we speak HD quality, I can see the IP path having more possibilities, as it is a scalable and quite far software developable technology. As supposed to DVB, which will require new hardware to support new broadcasting technolo-

gies, including HD. Because at the moment, the DVB-H technology, is based on 320x240 pixel screen size with a frame rate of 15 frames per second – which is of course way below the standards we are speaking for HD. Usually HD is considered to be larger than 1280 by 720 pixels and over 24 frames per second.

9 APPLICATION DESCRIPTION

Today we can, as earlier mentioned, see that there is a division of how to distribute the Mobile-TV content. On one hand we have the DVB-H technology that the traditional TV broadcasting companies are usually standing behind and on other we have IP based content delivery (i.e. 3GPP, specific apps, etc.).

In Finland we can see that DVB-H does have the upper hand as to what is known about mobile TV and to what that term is referenced to. The network was launched in Finland on the 1st of December 2006 and has been since then a controversial project, which has many times stood at the verge of being cancelled or shut down. However at the time of writing this thesis the DVB-H network covers 40% of Finland's population and they just received a continuity promise from the government, so the possibility to drive Mobile-TV into a mainstream application is there. Recently Nokia introduced an accessory for their telephones that converts a lot of their successful, already available on the market, telephones into DVB-H receivers. I can see this as possibly the biggest step towards making Mobile-TV a reality in Finland, in a long time.

As for IP delivered Mobile-TV in Finland, the situation is a little bit worse. It seems that most companies that are working with IPTV are concentrating on delivering the content home, not to your mobile device. Take as an example Yle Areena, part of the Finnish National Broadcasting Company's online presence. At the moment content is available on most platforms, i.e. your computer, TV and mobile device. But the mobile side of the solution is really lacking and only parts of the material can be accessed. One can see a lot of reasons or explanations for this, one being of course the rights of the content delivery. Meaning does the broadcasting company have the rights to distribute the material outside of the country they are working in. With Mobile-TV this can be a problem, as access of the IP networks can be basically done from anywhere in the world. Currently that limitation is handled by IP blocking, i.e. not allowing (some) of the content to be viewed if your computer has an IP that is not from Finland.

10 DESCRIPTION OF THE INTERVIEWS

Insights to Mobile-TV hits and misses were conducted by interviews. And early on in my research I could see that Mobile-TV has not been left out of the equation, but instead the view of what is considered to be Mobile-TV and how it will look like in the future has changed quite a lot.

10.1 Interview with Pasi Eronen, Telia Sonera

An interview was held with Telia Sonera's Content Services Manager TK, Pasi Eronen – who gave interesting insights on what and how Sonera has done on the front of Mobile-TV. It was interesting to hear from a company that at the moment seems to have jumped off the wagon, which they were on the forefront when the ideas of Mobile-TV were introduced. The first mobile video broadcast that Sonera ever made was a simulcast broadcast of CNN through their WAP portal called Surf Port. This was done as early as 2004 through 2G and EDGE networks, and the just introduced 3G networks. At that time though the network infrastructure could not handle high bit rate video material they could see that there is an interest to watch TV while on the go. From this successful first trial Sonera took a big leap in 2006 while being one of the main partners for the 2006 Winter Olympic Games in Torino. Sonera broadcasted a simulcast of the YLE live broadcasts, direct from Torino, over the current network structures. This was also a big lesson to Sonera, not only in a technical sense, but also in broadcast rights and location awareness. As YLE only had the rights to broadcast the Olympic Games in Finland, Sonera could not allow their customers to access the broadcast while abroad. After the success of these two trials with Mobile-TV over the standard 3GPP video protocols designed for mobile networks Sonera saw the potential of Mobile-TV, but also the restrictions of the 3GPP protocol. So they started developing their own video streaming application, called Sonera MobiTV. First client were for the Symbian platform and later on a Java version of the client was also introduced. The advantage of the application was great control over the quality of the material – which helped to stream video and sound through constantly changing network conditions. The software itself could either handle this automatically or the user could define themselves what quality would be

streamed. Unfortunately by this time DVB-H had gained momentum in Finland and nobody seemed to be interested in IP transferred simulcast broadcasts – and one of the reasons was probably the quality issue. As at this time, in 2006, the 3G networks weren't that wide spread and the speeds were nowhere near the speeds we get today, in 2010.

After that you can say that Sonera took a sidestep from Mobile-TV, as they didn't see a place for them as an operator to be diving into DVB-H. But they did not forget about the mobile user. Currently one of the big things for Sonera is their so-called KotiTV – i.e. Home TV – that is essentially a cable and IPTV service. With dwelling into the broadcasting business Sonera has been learning the valuable lessons of broadcast rights and content. And as Mr. Eronen says, there are four key things when looking at broadcasting; Content, Packaging, Distribution and the Consumer. Content can be bought and the Consumer is already there. So they have now found their position as the party to Package the Content and Distribute it to the Consumer. And here we come back to the part of Mobile-TV. The new thing in broadcasting, not only at Sonera, is the so-called 3 screen theory. You should, as a consumer, be able to watch your content on all your 3 screens – whether it is your big screen TV at home, your laptop at work or your mobile device on the move. And Sonera's aim is to package all this for you, the consumer, in a one deal package – so that when you decide to purchase or subscribe to their service, you will not only have access to watch cable TV, but the same content on both your laptop and mobile device. The challenge on the other hand are the licenses, not only have the operators and distributors seen that the consumer wants access to the material everywhere – also the producers and content creators have noticed this. And the distribution rights are very strict today – you, as a distributor, have to have licenses for all these distribution methods. It is not enough that if you have the right to broadcast let's say a TV show on your TV network that you would have the right to broadcast it also on your web catch-up TV service. No, there are separate licenses and distribution limitations that have to be considered.

But one thing is certain, after the interview with Sonera, they are going the IP way. But they will not stop at Mobile-TV, you should be able to watch the content anywhere and at any time you want!

10.2 Interview with John Grönvall, Arcada

An interview was conducted with John Grönvall, a researcher in new media at Arcada University of Applied Sciences, on the 20th of December 2010. Mr. Grönvall has been involved in several multimedia projects at Arcada and other instances, of which one is the Helsinki based Stadi.tv project (known as Dina TV until December 2010). Within this project a lot of Mobile-TV projects have also been conducted of which the biggest was probably during the 2007 Eurovision Song Contest. During the song contest Mr. Grönvall was conducting a project for recording and broadcasting the contest on both cable and Mobile-TV (DVB-H & SoneraTV). As stated the project was quite big, consisting of a staff of approximately 100 persons. The events were filmed with both mobile phones and professional broadcast equipment. This was a very interesting project especially in regards of Mobile-TV, as a lot of technologies were tested, which was in the sense of DVB-H in an early on stage. Not only was the programs broadcasted simultaneously over DVB-H and cable TV, but also a lot of interactive features were tested in the DVB-H broadcast. The consumers were for example able to vote and comment on performances in real-time through the DVB-H protocol. However successful the pilot was in 2007, today Mr. Grönvall considers that the limitations of the technology was back then and is still now quite limited. Why DVB-H was used in 2007 was simply because at that time it was the most advanced Mobile-TV technology available. IP based services were still in their early development stages and the networks were not able to provide high enough bitrates. DVB-H on the other hand, already at that time, was able to produce a consistent quality with low or no artifacts at all. Artifacts meaning then disturbances in the video feed of the broadcast.

During this pilot it was also tested and realized that the mobile viewer is viewing this content on the move and thus not interesting to watch long broadcasts, but short clips if you will, of 30 to max 90 seconds in length.

When asking Mr. Grönvall how he sees the future of Mobile-TV he actually is on the side of IP based on-demand services, especially for countries that have the infrastructure in place. Meaning that for countries like Finland, where the 3G networks are already wide spread and 4G is coming at a high speed – he sees no need for developing a new

infrastructure (like DVB-H) for delivering mobile video entertainment. He does how ever see the DVB-H technology as being a good service and especially feels that the continuous development of the standard could show good use for it in the future. As an example he takes Africa and Sofia Digitals project over there. Where in countries and cities where there are no phone or internet infrastructure let alone a wireless infra, the DVB-H standard can actually bring all of them wirelessly and with a good coverage range.

11 ANALYSIS

11.1 Problems and limitations

The main problem with mobile TV could be seen as the separation of the technologies and of course the availability and quality of the networks. In my studies, work and research for this thesis I've actually ensured my view that Mobile-TV still could become the next big thing even in Finland. But what really needs to happen is that some decisions are made in Finland and of course from the device manufacturers. On the manufacturer side of things the main problem today is that (for the Finnish market) only one is creating DVB-H devices and that is Nokia. This limitation is a problem and I can see the future of DVB-H hanging a lot on the availability of devices that can receive the content. But DVB-H is not the only one with problems here; IPTV has also its own limitations and problems. One of these being the network itself, the capacity and with that the cost of using this capacity. The streaming of video uses a lot of the network capacity and of course as more capacity is needed, more capacity "has" to be made available and this will cost – and who will pay, that is of course the user. This will probably be seen as data caps (restriction of amount of data that is allowed to be downloaded each month) and rising of prices for so called unlimited data packages. And this is not just speculation, as this can already now be seen in the US, where IPTV and tablet devices (as the iPad) and mobile telephones with large screens (like the 4" Android smartphones or the iPhone) are using a lot of bandwidth (News article, 2010) and even causing networks to crash.

What ever the technology of choice will be the two most important challenges are the availability of content and consumer devices.

11.2 The Future

DVB-H has just at the time of writing this received an agreement of continuity in Finland. (mobiliitv.fi press release, 2010). So at least DVB-H has the government's backup for development. How it then looks as consumer service is then totally up to the distributors and service providers – to offer interesting content for a compelling price – and of course, I cannot distress this enough, availability of consumer playback devices.

As for the IP view of mobile entertainment I also see a bright future for this, as the big mobile phone operators seem to be looking and investing into this. As I found out from the interview with Pasi Eronen at Telia Sonera, it is however not mobile-tv services in the traditional sense they will be developing, but instead the so-called three screen policy. Which in my ears sounds like an excellent plan from the consumer side of things, the availability to view the content you want, where you want, when ever you want – with only one payment scheme.

Not to make the foretelling of the future too easy the year 2016 is extremely close. Why I bring up this year is that that is the year when current broadcast licenses in Finland expire. After that basically anything can happen, DVB-T or T2 might be gone as well as DVB-H and instead something totally different – maybe IPTV?

12 CONCLUSIONS AND DISCUSSIONS

What I would like to see is a decision. In the end I, nor the basic user, care what technology or how the content is delivered – we just want to consume it. Whether it is DVB, DMB or IP we do not care, as long as it is made easy to access.

But at the moment I see a more bright future for the IPTV solution. This can be used for both simulcast and on-demand content and is extremely versatile. And by versatile I especially mean the scalability to offer the same content to your HDTV, computer and mobile device. A good example of this is the online rental company Netflix, who started as a DVD rental and online streaming company – but now offers material to all your devices, from your computer to your TV and mobile device. Actually this has gone so far that online rentals have surpassed DVD rentals just recently (online article, 2010).

This is in the view of Finland. As Mr. Grönvall brought up in his interview, DVB-H or similar technologies, have an advantage and a good future in places where there is no infrastructure available for broad services. Of course one could argue that you can establish this with IP based solutions and just build a 3G network – but I do also see DVB as a better solution here.

As for the part of a killer application, that has been obviously missing, I have to say that it is not so much a service that is missing. Like in my example of SMS or internet on mobile devices, launching mobile telephony to mainstream. But instead the killer application that has been missing is the control and unity. There has been little or no standards of purchasing, delivery or consumption of the content.

Purchasing of content and the licenses to distribute it has to be clarified by all parties. In view of this I feel the Telia Sonera three-screen look to things is actually a really good thing. The consumer would not need to worry about several different sources for material, but can instead trust that the operator or distributor if you will, would have access to all material that you as a consumer would want to consume. And Telia Sonera is not the only one experimenting in delivering content to their customers through new channels. Just recently Elisa and daughter company Saunalahti introduced availability to use the online video rental service Voddler (partly) for free to their current broadband and/or KotiTV users.

The expectations of the delivery of material are high. We are on the verge of accepting and expecting that all our material delivered to the home is in High Definition, so why would we not want it on the go. The technical aspect is not important, but the ease of use and quality on the consumed playback device.

And last but not least, communication. As noted in this thesis several times, Finland has been on the forefront of mobile entertainment since the beginning of the concept, but still few people know of this. Even I, who have been working in the business for many years, was surprised several times during this process of things that had been conducted in Finland, and even in the public, without my knowledge. That is just one view of how badly the communication has been handled.

But in the end it is clear that there is a demand, how small it might be today, for mobile availability of entertainment. And I think it will just keep on growing with the introduction of such devices as the iPad and other tablet devices and smart phones.

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14 TERMINOLOGY AND CONCEPTS

- **Operator;** mobile operator or tv broadcaster, who has the operative responsibility of Mobile-TV
- **Distributor;** the party that distributes or broadcasts the content to the consumer
- **Mobile-TV**; for this thesis, mobile delivery of video content.
- **DVB(-H/T/C/S);** Digital Video Broadcasting (DVB) is a suite of internationally accepted open standards for digital television. DVB standards are maintained by the DVB Project, an international industry consortium with more than 270 members, and they are published by a Joint Technical Committee (JTC) of European Telecommunications Standards Institute (ETSI), European Committee for Electro technical Standardization (CENELEC) and European Broadcasting Union (EBU). The interaction of the DVB sub-standards is described in the DVB Cookbook.[1] Many aspects of DVB are patented, including elements of the MPEG video coding and audio coding.
- **Multimedia Broadcast and Multicast Services** (**MBMS**) is a broadcasting service offered via existing GSM and UMTS cellular networks. The main application is mobile TV. The infrastructure offers an option to use an uplink channel for interaction between the service and the user, which is not a straightforward issue in usual broadcast networks, as for example conventional digital television is only a one-way (unidirectional) system. MBMS uses multicast distribution in the core network instead of point-to-point links for each end device.
- **3GPP**; general specification of video delivery over mobile networks. A simplified version of MPEG4/h.263 material defined by the 3GPP group. Also includes META data that can scale material to playback device
- **MPEG**; Moving Picture Expert Group, a group who develops standards for video compression technologies. In mobile technology MPEG4 is the most used format.
- **Digital Multimedia Broadcasting (DMB)**; is a digital radio transmission technology developed in South Korea as part of the national IT project for sending multimedia such as TV, radio and data casting to mobile devices such as mobile phones. This technology, sometimes known as mobile TV, should not be confused with Digital Audio Broadcasting, which was developed as a research

project for the European Union. DMB was originally developed in South Korea as the next generation digital technology to replace the FM radio. Used mainly in South Korea (T/S-DMB) and Norway (T-DMB)

- **Java**; programming language. In the context of mobile devices, usually an application.
- **ARPU**; Average revenue per user (sometimes average revenue per unit) usually abbreviated to ARPU is a measure used primarily by consumer communications and networking companies, defined as the total revenue divided by the number of subscribers.

15 APPENDICES

Appendix A.

Excerpt of Hollywood Reporter article from October 20th, 2010:

Netflix: Online Streams to Surpass DVD Rentals

DVDs are so yesterday, judging by what's happening with the company that made a fortune by stuffing them in envelopes and mailing them to subscribers nationwide., Netflix users will watch more movies and TV shows streamed online than they will on DVD during the fourth quarter, the company said Wednesday in announcing impressive quarterly results., Netflix said 66% of its users watched something streamed during the third quarter, up from 41% during the same quarter a year ago. Because so much content is viewed streamed, Netflix said it no longer will bother to report the metric., "By every measure, we are now primarily a streaming company that also offers DVD-by-mail," Netflix CEO Reed Hastings said., Answering a question from a skeptical analyst Wednesday, Hastings said that Netflix compares minutes streamed to the length of every DVD shipped. Minutes streamed during the fourth quarter will exceed the number of combined minutes of all DVDs mailed to subscribers., On the financial front, third-quarter earnings rose 26% to $38 million on revenue up 31% to $553 million. The company added 1.9 million subscribers to end the quarter with 16.9 million., Netflix also lifted its guidance, saying it will end the year with up to 19.7 million subs; previously, it predicted up to 18.5 million., Churn fell from 4.4% a year ago to 3.8%, and subscriber-acquisitions costs dropped 26% to $19.81., Shares of Netflix rose 3% during Wednesday's regular session to $153.15 and an addition 9% after hours once third-quarter results were released., Hastings said Wednesday that even though streaming will overtake DVDs, he won't shut down distribution centers anytime soon as they are needed to ensure quick delivery., He also said Netflix subscribers, while rabid fans of streaming premium video, are not TV "cord-cutting" at a rate larger than the general population., Hastings said Netflix streamers are doing so on several devices, given that they might use a game console in one room and a Blu-ray Disc player in another while using an iPhone for their mobile needs., The CEO made it clear that streaming is overtaking DVDs even as Netflix increases the number of discs it ships.

Appendix B.

Press release on mobiilitv.fi, from September 9th, 2009

Mobiili-tv-verkko sai jatkoajan

Valtioneuvosto on tänään 9. syyskuuta tehnyt päätöksen maanpäällisen joukkoviestintäverkon kanavanippuja C, D ja E koskevissa toimilupamuutosasioissa. Päätöksen mukaan D-kanavanippu varataan edelleen mobiili-tv-verkolle, koska muutos heikentäisi merkittävästi mobiilitelevision verkkoliiketoiminnan käynnistymistä.

"Päätös oli sinänsä perusteltu eli näin mobiili-tv saa vielä mahdollisuuden päästä vauhtiin. Edessämme on kuitenkin monia haasteita. Palvelua tarjoaa tällä hetkellä vain yksi palveluoperaattori ja päätelaitteiden sekä sisällön osalta on selkeä tarve laajentua, jotta liittymämäärät saadaan nousuun. Mielestämme asiaa olisi kuitenkin hyvä tarkastella esimerkiksi vuoden päästä uudelleen ja katsoa, onko palvelulle tilausta Suomen markkinoilla. Teemme palveluoperaattorina toimivan DNAn kanssa yhdessä töitä mobiili-tv-palvelun eteen ja yritämme vauhdittaa palvelun kaupallista käynnistymistä. Lisäksi käymme keskusteluja myös muiden palveluoperaattorien kanssa kuluttajatarjonnan lisäämiseksi. Uskomme, että tv siirtyy mobiiliin, mutta teknologia saattaa olla jokin muu kuin DVB-H," toteaa liiketoimintajohtaja Jaakko Harno Digitasta.

Lisäksi valtioneuvoston päätöksessä todetaan, että Digita voi korvata yhden SD-tasoisen E-kanavanipun teräväpiirtolähetyksillä vuonna 2013. Eli kanavanipun E:n toimilupaa muutetaan siten, että verkon toteutuksessa käytettävä tekniikka voi vuoden 2013 alusta olla myös DVB-T2-standardin mukainen ja kuvanpakkaustekniikkana voidaan käyttää MPEG4-tekniikkaa. Kanavanippu C:n toimilupaehtoja ei muuteta, koska digitaaliseen televisioon siirtymisen yhteydessä keskeiseksi lähtökohdaksi otettiin, että nykyisillä päätelaitteilla voidaan vastaanottaa televisiolähetyksiä ainakin vuoden 2016 loppuun asti.

"Digita haki toimilupamuutosta C-, D- ja E-kanavanippuihin. Muutos olisi tuonut lisämahdollisuuksia DVB-T2-lähetystekniikan avulla erityisesti teräväpiirtopalvelujen tarjontaan, mikäli markkinatilanne esimerkiksi päätelaitteiden ja kuluttajakysynnän osalta kehittyisivät tähän suuntaan, kuten Digitassa vahvasti uskomme. Mielestämme teknologianeutraalius, taajuuksien tehokas käyttö ja monipuolinen verkkotarjonta palvelisivat kuluttajaa paremmin", Harno jatkaa.

Digita/Viestintä

Appendix C.

Video-On-Demand Now 27% Of Internet Traffic: Study

Peer-to-Peer Usage Falls to 20% of Total, vs. 32% In 2008

By Todd Spangler -- Multichannel News, 10/26/2009

Video and audio streaming from sites such as YouTube and Hulu now accounts for about 27% of the Internet's global traffic -- up from 13% in 2008 -- while consumption by peer-to-peer applications has dropped as a percentage of the total, according to a report by network-management systems vendor Sandvine.

Peer-to-peer file sharing represented 20% of all usage on the 2009 survey of 20 Internet service providers worldwide, compared with 32% in 2008. Even though the amount of traffic consumed by P2P applications continues to grow on an absolute basis, video-on-demand applications are growing more quickly, Sandvine CEO Dave Caputo said.

"Peer-to-peer is yesterday's Internet story," Caputo said. "Every category is growing in aggregate bandwidth, but bandwidth as a percentage is undergoing a massive shift to video."

Sandvine's 2009 Internet traffic trends report is based on data from more than 20 cable, DSL and fiber-to-the-home service provider networks representing 24 million subscribers worldwide.

An Internet-usage survey **Cisco Systems issued last week** also found P2P traffic had declined from previous levels, although it pegged peer-to-peer at 38%.

According to the Sandvine report, the mean average usage per subscriber is around 8 Gigabytes per month, while the median is about 3 Gbytes per month. The top 1% of Internet users accounts for nearly 25% of consumption, a cohort that uses 200 times the data per month as the average user.

The Internet's peak-usage window shrank by two hours, from 6-11 p.m. in 2008 to 7-10 p.m. in 2009, in Sandvine's analysis. During that "primetime" period, the usage profile among all users was roughly equivalent, whereas the heaviest users (sometimes called "bandwidth hogs") use their connections 24 hours per day. "From 7 to 10 p.m., we're all consumption kings," Caputo said.

Given the 7-10 p.m. usage peak, Caputo noted, service providers have a strong incentive to try to encourage the use of non-real-time application at other times. "If you could shift some of that usage to the other 21 hours everybody would win," he said.

The data for Sandvine's report was gathered between Sept. 1-22 and captured the bits-per-second, per protocol and the number of active hosts per protocol on the network. The data does not include any subscriber-specific information, such as IP addresses.

Appendix D.

Broadband Users Consume 11.4 Gbytes Per Month: Cisco Study

Vendor Surveyed More Than 20 Service Providers Worldwide

By Todd Spangler -- Multichannel News, 10/21/2009

About 10% of the world's broadband subscribers generate more than 60% of all Internet traffic, with the average connection chewing up about 11.4 Gigabytes of Internet traffic per month, according to a Cisco Systems survey of more than 20 service providers.

Meanwhile, the top 1% heaviest global subscribers account more than 20% of all traffic, Cisco found.

The networking company's Visual Networking Index (VNI) Usage report represents activity during the third quarter of 2009 aggregated from cable, wireline telco, and mobile providers in North America, Latin America, Europe, Asia Pacific and various emerging markets.

Globally, the average broadband connection consumes about 4.3 Gbytes of video and other "visual networking applications" (such as social networking) per month. That's the equivalent of approximately 1.1 hours of Internet video, according to Cisco.

Peer-to-peer traffic represented about 38% of all Internet traffic, which was a significant decrease from Cisco's earlier pilot studies that showed P2P accounting for more than half of all bandwidth used, said Doug Webster, senior director of market management in Cisco's Service Provider Group.

"There's been an assumption that peer-to-peer is taking up the majority of the traffic," Webster said. "But the relative percentage of peer-to-peer is decreasing because of the rise in other application types."

Cisco also found a common "Internet primetime," across all geographies, which spans approximately 9 p.m to 1 a.m. around the world. About 25% of global Internet traffic -- or 93.3 Mbytes per day per connection -- is generated during the Internet "primetime" period.

The company plans to provide future updates to the usage data to measure changes in overall Internet traffic patterns. The new study is separate from the company's Visual Networking Index Forecast and Methodology 2008-2013, which projects that IP traffic will quintuple over that five-year period.